Original Article

Mediating effects of preoperative fear and anxiety on postoperative pain intensity

Efeitos mediadores do medo e ansiedade pré-operatórios na intensidade da dor pós-operatória

Efectos mediadores de la ansiedad y del miedo preoperatorio en la intensidad del dolor posoperatorio

George Luís Teixeira[1] https://orcid.org/0009-0008-2268-4163
Daniely Gomes Marques[2] https://orcid.org/0009-0000-9158-8089
Evelyn Alves dos Santos[2] https://orcid.org/0009-0008-7159-9854
Priscilla Hortense[2] https://orcid.org/0000-0003-0554-451X
Anamaria Alves Napoleão[2] https://orcid.org/0000-0002-6229-4206
Emilia Campos de Carvalho[3] https://orcid.org/0000-0003-0738-0539
Aline Helena Appoloni Eduardo[2] https://orcid.org/0000-0003-1577-3383

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Corresponding author
Aline Helena Appoloni Eduardo
E-mail: alinehaeduardo@ufscar.br

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Thiago da Silva Domingos
(https://orcid.org/0000-0002-1421-7468)
Escola Paulista de Enfermagem, Universidade Federal de São Paulo, São Paulo, SP, Brasil

Abstract

Objective: To identify the mediating effects of preoperative fear and anxiety on postoperative pain intensity in people undergoing elective surgeries up to six months after surgery.

Methods: This is an observational and longitudinal study with quantitative analysis, carried out with 172 adult patients admitted to a hospital and undergoing elective surgeries. The instruments used were: form for characterizing sociodemographic, clinical and surgical variables; Hospital Anxiety and Depression Scale; Surgical Fear Questionnaire; and Numeric Rating Scale for pain assessment. The interviews were carried out during the preoperative period, 48 hours after surgery and monthly until six months after surgery. For the descriptive statistical analysis of the explanatory variables, the absolute and relative frequencies, mean, standard deviation, median and minimum and maximum values were used. The relationship between the variables studied was analyzed using measures of correlation and mediating effects (structural equation model, maximum likelihood method).

Results: During the postoperative period (6 months), the mean pain ranged from 4.86 to 1.19. The means for anxiety (7.62) and fear (25.2) related to surgery were calculated. The analysis of variables showed a positive correlation between both preoperative fear and anxiety with the highest pain levels assessed at different moments in the postoperative period. Furthermore, preoperative anxiety exerted a mediating effect on the relationship between fear related to surgery, manifested in the preoperative period, and postoperative pain in the first 48 hours after surgery.

Conclusion: Psychological variables, such as preoperative fear and anxiety, influenced postoperative pain intensity in people undergoing elective surgeries. Nursing interventions aimed at anxiety and fear may be useful for surgical patients.

Resumo

Objetivo: Identificar os efeitos mediadores do medo e ansiedade pré-operatórios sobre a intensidade da dor pós-operatória em pessoas submetidas a cirurgias eletivas até seis meses após cirurgia.

Métodos: Estudo observacional e longitudinal de análise quantitativa foi realizado com 172 pacientes adultos internados em uma instituição hospitalar e submetidos a cirurgias eletivas. Os instrumentos usados foram: formulário para caracterização de variáveis sociodemográficas, clínicas e cirúrgicas; Escala Hospitalar de Ansiedade e Depressão; Escala de Medos Relacionados a Cirurgia e Escala de Categoria Numérica para dor. As entrevistas foram realizadas no período pré-operatório, 48 horas após a cirurgia e mensalmente até completar seis meses do pós-operatório. Para a análise estatística descritiva das variáveis explanatórias, foram usadas as frequências absoluta e relativa, média, desvio padrão, mediana e os valores mínimo e

[1]Santa Casa de Misericórdia de Barretos, Barretos, SP, Brazil.
[2]Universidade Federal de São Carlos, São Carlos, SP, Brazil.
[3]Escola de Enfermagem de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil.
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máximo. A relação entre as variáveis estudadas foi analisada usando as medidas de correlação e dos efeitos mediadores (modelo de equações estruturais; método de máxima verossimilhança).

Resultados: No período pós-operatório (6 meses), a média de dor variou de 4,86 a 1,19. As médias de ansiedade (7,62) e medo (25,2) relacionados à cirurgia foram calculadas. A análise das variáveis mostrou correlação positiva tanto do medo como da ansiedade pré-operatórios com os níveis de dor mais elevados avaliados em distintos momentos do período pós-operatório. Além disso, a ansiedade pré-operatória exerceu um efeito mediador na relação entre o medo relacionado à cirurgia, manifestado no período pré-operatório, e a dor pós-operatória nas primeiras 48 h após a cirurgia.

Conclusão: As variáveis psicológicas, medo e ansiedade pré-operatórios, influenciaram a intensidade da dor pós-operatória em pessoas submetidas a cirurgias eletivas. Intervenções de enfermagem voltadas para ansiedade e medo podem ser úteis aos pacientes cirúrgicos.

Resumen

Objetivo: Identificar los efectos mediadores de la ansiedad y del miedo preoperatorio sobre la intensidad del dolor posoperatorio en personas que realizaron cirugías electivas hasta los seis meses posteriores a la cirugía.

Métodos: Se realizó un estudio observacional y longitudinal de análisis cuantitativo con 172 pacientes adultos internados en una institución hospitalaria y sometidos a cirugías electivas. Los instrumentos utilizados fueron: formulario para caracterización de variables sociodemográficas, clínicas y quirúrgicas; Escala Hospitalaria de Ansiedad y Depresión; Escala de Miedos Relacionados con Cirugías y Escala de Categoría Numérica del Dolor. Las entrevistas se realizaron en el período preoperatorio, 48 horas después de la cirugía y mensualmente hasta completar seis meses de posoperatorio. Para el análisis estadístico descriptivo de las variables explicativas, se utilizaron las frecuencias absoluta y relativa, promedio, desviación típica, mediana y valores mínimo y máximo. La relación entre las variables estudiadas se analizó utilizando las medidas de correlación y de los efectos mediadores (modelo de ecuaciones estructurales, método de máxima verosimilitud).

Resultados: En el período posoperatorio (6 meses), el promedio del dolor varió de 4,86 a 1,19. Se calculó el promedio de ansiedad (7,62) y miedo (25,2) relacionado con la cirugía. El análisis de las variables demostró correlación positiva tanto de la ansiedad como del miedo preoperatorio con niveles de dolor más altos evaluados en distintos momentos del período posoperatorio. Además, la ansiedad preoperatoria tuvo un efecto mediador en la relación entre el miedo relacionado con la cirugía (manifestado en el período preoperatorio) y el dolor posoperatorio en las primeras 48 horas después de la cirugía.

Conclusión: Las variables psicológicas, ansiedad y miedo preoperatorio, influyeron en la intensidad del dolor posoperatorio en personas que realizaron cirugías electivas. Las intervenciones de enfermería orientadas hacia la ansiedad y el miedo pueden ser útiles para pacientes quirúrgicos.

Introduction

Hospitalization and surgeries impact each individual differently and particularly, and can cause changes in emotional and physical states, negatively influencing responses to treatment and postoperative recovery. Studies have associated fear and anxiety present in the preoperative period with high levels of postoperative pain, use of analgesia and surgical complications. These complications were responsible for increased surgical recovery and hospitalization times, costs related to surgery and personal reports of dissatisfaction with treatment. To better understand the mediating effect of fear and anxiety on postoperative pain,[1-4] the present study sought to verify whether preoperative fear and anxiety influence postoperative pain intensity and whether it persists for different periods of time after surgery.

Fear is an emotional reaction to a traumatic event, which triggers an immediate alarm response. Fear is related to surgery, anesthesia, movement after surgery, possible incapacitation and loss of functionality of the operated organ, surgery failure and death.[1,5-7]

Anxiety is an emotional response to threat, in which people anticipate an imminent, nonspecific danger, catastrophe, or misfortune. Preoperative anxiety results in worry, discomfort and fear. It can begin when the patient is informed about the surgery, reaching its peak during hospitalization, before surgery. Preoperative anxiety can make anesthesia induction and maintenance difficult, increase the need for anesthetics and cause nausea and vomiting. These effects are related to autonomic fluctuations caused by anxiety. They are responsible for gastrointestinal stimulation and keeping people in a state of alert.[1,4,6]

What is already known about the relationship between preoperative fear and anxiety and the psychosocial and physical damage experienced by people who have undergone surgery justifies the development of studies and interventions aimed at these manifestations in the perioperative context. Adequate management of preoperative fear and anxiety may be related to the reduction of psychological morbidities, complications and postoperative pain. The latter is the main consequence of the presence of preoperative fear and anxiety.[1,8,9] A meta-analysis of data from 53,362 patients undergoing elective surgeries showed preoperative anxiety as a predictor of resistance to pain control in the postoperative period.[10]

Postoperative pain is among the most unpleasant symptoms associated with surgery. Its intensity is related to the development of chronic postsurgical pain, which compromises people's quality of life, surgical and rehabilitation results, and satisfaction with surgery.[11,12]

Identifying fear and anxiety is fundamental in perioperative nursing care, which is based on the Nursing Process (NP). The NP provides elements for comprehensive, continuous and individualized care, especially in the preoperative period. It focuses on the preoperative visit to identify individual needs and prepare anesthetic-surgical procedures, reducing anxiety and fear, thus contributing to patients' recovery.[13]

Considering the impacts of preoperative fear and anxiety on postoperative pain, it is important to detect their manifestations among people undergoing surgery. It is also important to describe how they impact the occurrence of this type of pain, as this is little evidenced in the literature. Data from our study should add knowledge about the relationship between fear and anxiety and postoperative pain, contributing to better care for surgical patients and future development of interventions to reduce these factors.

This study aimed to identify the mediating effects of preoperative fear and anxiety on postoperative pain intensity in people undergoing elective surgeries up to six months after surgery.

Methods

This observational, longitudinal and quantitative study was carried out at a secondary hospital (surgical hospitalization unit) in the countryside of the state of São Paulo. This report was supported by the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines.

The convenience sample consisted of hospitalized people whose data were included in the surgical planning during the data collection period from January 2019 to April 2020. They met the inclusion and exclusion criteria and agreed to participate in the study. Inclusion criteria, as described in the medical record, were being 18 years of age or older, understanding Portuguese, waiting for elective surgery, not presenting a medical diagnosis indicating cognitive impairment, having poor hearing and visual acuity and not presenting serious psychiatric conditions. Exclusion criteria were admission to the Intensive Care Unit after surgery, preoperative period of obstetric surgery and inability to understand the questions during the interview or to communicate verbally (both assessed subjectively by the researchers).

The total sample number was calculated using Van Voorrhis and Morgan criteria for observational studies: n=50+8m, where n is the total sample and m is the number of independent variables. As preoperative fear and anxiety were the independent variables of the study, the minimum sample was estimated at 66 participants.[14]

The study protocol consisted of interviews carried out with participants approximately 24 hours before and after (24 hours and 30, 60, 90, 120, 150 and 180 days) the surgery. The interviews carried out before surgery and 24 hours after surgery took place at the institution. The following interviews were conducted by telephone after discharge.

In the preoperative period, participants received explanations about the research, signed the Informed Consent Form and responded to the form to characterize sociodemographic, clinical and surgical variables: Surgical Fear Questionnaire (SFQ); Hospital Anxiety and Depression Scale (HADS); and the Numeric Rating Scale (NRS) for pain assessment. All of them were applied by researchers.[15-21] The form to characterize sociodemographic, clinical and surgical variables was composed of information on age, sex, education, marital status, professional status, type of surgery and anesthesia and comorbidities. After surgery, this form was completed with possible postoperative complications and reoperations. In interviews carried out in the postoperative period, participants only filled out the NRS.

The SFQ is an eight-item scale on specific fears felt in the preoperative period, which was organized into the domains "fear of short term consequences of surgery" (five items) and "fear of long term con-

sequences of surgery" (three items). Each item has a 0-10 score, where zero indicates "not at all afraid" and 10 indicates "very afraid". The total score is obtained by adding the answers given in each item, where higher values mean higher levels of fear related to surgery (no cut-off point). The SFQ was translated and adapted for use in Brazil; psychometric analyzes indicated its use with adequate levels of reliability (Cronbach's alpha = 0.85) and validity, accessed by convergent and discriminant construct validity.[15,16]

The HADS is a scale that allows the assessment of anxiety and depression among people hospitalized in non-psychiatric clinical hospitals. It was validated for use in Brazil, being organized into two parts: one with items to assess anxiety (HADS-A) and the other with items related to depression (HADS-D). In this study, only HADS-A was applied, consisting of seven items with response options ranging from 0-3. The answers are added together and the maximum score is 21 points and the presence of anxiety is considered when the sum of items is equal to or greater than seven. The HADS was validated among surgical patients by investigating the correlation between the items in each part of the scale (0.27-0.55) with the total score (0.47-0.63), resulting in high reliability (Cronbach's alpha = 0.81) and adequate validity.[17-20]

The NRS is widely used to measure pain intensity; the patient must estimate their pain within a scale of 0-10, where 0 means "no pain" and 10 means the "the worst pain ever possible". It is recommended for clinical settings and for people over the age of nine who are able to use numbers to estimate the intensity of their pain.[21] A systematic review on NRS indication to assess postoperative pain showed that the results on convergent validity with other pain assessment measures are adequate. Correlations with other measures had a moderate to high variation (0.50-0.90), and the results showed adequate reliability after test-retest measurements, inter-rater analysis and internal consistency.[22]

Collected data were analyzed using STATA software (v. 14.0). For descriptive analysis of continuous variables, mean, standard deviation, minimum and maximum values of categorical variables, frequency and percentage were calculated. Spearman's Correlation Coefficient was used to assess the relationship between surgery-related fears and anxiety about postoperative pain after confirming that the sample did not follow a normal distribution (Shapiro-Wilks test).

To analyze the possible direct, indirect and total mediation effect, a structural equation model, maximum likelihood method, was used. The model tested considered that fear related to surgery was correlated with postoperative pain (direct effect) and part of this relationship was mediated by anxiety (indirect effect). In all analyses, a significance level of 5% was adopted.

This study was approved by the Research Ethics Committee of the responsible institution 3,099,379 (Certificate of Presentation for Ethical Consideration (*Certificado de Apresentação para Apreciação Ética*) 01677118.0.0000.5504).

Results

A total of 172 participants were included, and 138, 137 and 136 of them were, respectively, interviewed at 30, 60-150 and 180 days after surgery. Participants had a mean age of 43.0 years (minimum-maximum: 18-78; standard deviation, SD: 15.1); participants were women (n=86; 50.0%) and the majority of the sample was married (n=80; 46.5%). Regarding education, they had primary education (n=62; 36.0%), secondary (n=88; 51.2%) and higher education (n=15; 8.72%) or had never attended school (n=05; 2.91%). The majority of them were in an active professional situation (n=127; 73.8%); the rest were away from work (n=25; 14.5%) or were retired (n=20; 11.6%). The surgeries performed were orthopedic (n=108; 62.8%), general (n=32; 16.6%), oncological (n=15; 8.72%) and others (n=17; 9.88%); 16 (11.6%) participants had complications (surgical site infection and erectile dysfunction); and only one of them (0.58%) required reoperation. The majority of participants received general anesthesia (n=67; 38.9%); the others received regional anesthesia with or without sedation (n=65; 37.8%); 40 (33.3%) of them

did not have information about anesthesia in their medical records. The majority of the sample had no comorbidities (n=133; 77.3%). The mean for fear related to surgery (assessed by SFQ) was 25.2±19.8 and the mean for anxiety (assessed by HADS-A) was 7.62±5.39; 83 (48.2%) participants presented values above the cut-off that indicated anxiety at the time assessed. Regarding pain, the mean in the preoperative assessment was 2.80±3.69; In other postoperative assessments, pain intensity varied in the range of 4.86-1.19, identifying a decrease in responses in pain levels during follow-up. Table 1 shows the mean, SD, minimum and maximum values of the results obtained in these assessments.

Table 1. Mean, SD, minimum and maximum values of responses obtained by the SFQ, HADS-A and NRS scales at assessment times

Instrument	Mean	Standard deviation	Minimum	Maximum
HADS-A	7.62	5.39	0	21
SFQ	25.22	19.85	0	80
Fear of short term consequences of surgery	9.52	8.67	0	30
Fear of long term consequences of surgery	15.69	13.73	0	50
NRS				
Before surgery	2.80	3.69	0	10
24 hours after surgery	4.38	0.56	2	5
30 days after surgery*	3.11	2.58	0	10
60 days after surgery**	2.93	2.55	0	9
90 days after surgery**	2.74	2.36	0	8
120 days after surgery**	4.86	0.18	4.14	5
150 days after surgery**	1.78	1.77	0	7
180 days after surgery***	1.19	1.42	0	6

*138 participants, **137 participants, ***136 participants; SFQ – Surgical Fear Questionnaire; HADS-A - Hospital Anxiety and Depression Scale - Anxiety; NRS - Numeric Rating Scale

The investigation of correlations between preoperative fear and anxiety and postoperative pain intensity indicated that the relationship between these variables was positive. Surgical fear was correlated with postoperative pain at all assessment times. Anxiety was correlated with postoperative pain up to 60 days after surgery (Table 2).

The mediating effects of preoperative fear and anxiety on postoperative pain intensity were analyzed on the first postoperative day. Fear had a direct effect on postoperative pain (estimated coefficient: 0.064; p<0.01) and anxiety (estimated coefficient: 0.164; p<0.01). Anxiety also had a direct effect on pain (estimated coefficient: 0.114; p=0.04). Analysis of indirect effect of fear on pain showed that there was a mediation effect (estimated value: 0.019; p=0.04). The mean increase of 0.019 points in postoperative pain is explained by the effect of fear on HADS-A. Analysis of direct effect of surgery-related fear on postoperative pain showed that postoperative pain had an average increase of 0.06 points for each unit increase in the fear score. Analysis of total effect of the same variables showed that, in general, an increase of one unit in fear causes an average increase of 0.083 points in postoperative pain (Table 3).

Table 2. Spearman correlation strengths between the variables obtained by the SFQ, HADS-A and NRS scales at the assessment moments

Time of pain assessment	SFQ (p-value)	HADS-A (p-value)
Before surgery	0.278 (<0.000)	0.350 (<0.000)
24 hours after surgery	0.486 (<0.000)	0.363 (<0.000)
30 days after surgery*	0.295 (<0.000)	0.190 (0.026)
60 days after surgery**	0.290 (<0.001)	0.193 (0.024)
90 days after surgery**	0.251 (0.003)	0.120 (0.161)
120 days after surgery**	0.295 (0.000)	0.168 (0.050)
150 days after surgery**	0.246 (0.001)	0.131 (0.128)
180 days after surgery***	0.246 (0.004)	0.143 (0.097)

*138 participants, **137 participants, ***136 participants; SFQ – Surgical Fear Questionnaire; HADS-A - Hospital Anxiety and Depression Scale - Anxiety; NRS - Numeric Rating Scale.

Table 3. Direct, indirect and total effects on fear, anxiety and postoperative pain

Variables	Estimated coefficient*	p-value	(95%) Confidence Interval	
Direct effect of anxiety on fear related to surgery	0.164	<0.01	0.132	0.196
Direct effect of anxiety on postoperative pain	0.114	0.04	0.006	0.221
Direct effect of surgery-related fear on postoperative pain	0.064	<0.01	0.035	0.094
Indirect effect of surgery-related fear on postoperative pain mediated by anxiety	0.019	0.04	0.001	0.037
Total effect of anxiety on postoperative pain	0.114	0.04	0.006	0.221
Total effect of surgery-related fear on postoperative pain	0.083	<0.01	0.060	0.107

*Structural equation model

Discussion

This study identified moderate levels of preoperative fear and anxiety in the sample and the correlation of

these variables with postoperative pain intensity up to 180 days after surgery. Fear had a direct effect on postoperative pain and an indirect effect on anxiety, which mediated the relationship between fear and postoperative pain.

The findings of this and other studies indicate the importance of an individualized approach to surgical patients to recognize and reduce preoperative fear and anxiety levels, as psychological factors such as fear and anxiety are risk factors for surgical pain.[10,12,23]

The levels of fear found among participants in this study were moderate and similar to those observed in other studies, but influenced the manifestations of postoperative pain. To date, a cut-off value for fear verified by the SFQ has not been established, but it is known that higher scores are related to higher levels of fear.[8,10,15,24]

The occurrence of preoperative fear and its postoperative consequences have been little investigated, but fear has been related to postoperative pain, which is linked to increased length of stay, greater consumption of analgesics and the development of chronic surgical pain. Surgical pain is a serious clinical condition that should receive attention from nurses, as it is related to compromised quality of life, prolonged surgical recovery and delay in resuming daily personal and work activities.[24-27]

In studies of people undergoing elective surgery, the frequency of anxiety varied in the range of 8-80%. This high frequency makes anxiety the most observed psychological reaction among people awaiting surgery. A European multicenter study carried out with 100 people undergoing bariatric surgery found a relationship between preoperative anxiety levels and pain intensity in the first 24 hours of surgery, although at moderate levels. A review concluded that anxiety influences postoperative pain intensity, both in terms of the need for analgesia and anesthetics and in increasing postoperative morbidity and mortality.[9,28,29]

The literature describes that anxiety influences postoperative pain. However, this study did not show a direct effect of anxiety on the pain expressed by patients; on the other hand, the presence of anxiety was associated with fear, indirectly intensifying pain intensity.[10,28]

Fear and anxiety can be difficult to differentiate. In some studies, they were treated as synonyms although distinct concepts had already been defined. Anxiety is recognized as a long-term response stimulated by non-specific, future threats, whereas fear is a short-term response to a threat recognized in the present.[30]

Considering the experience of undergoing surgery and the findings of this study, the occurrence of preoperative fear and anxiety overlap and must be assessed and identified in the perioperative period. Hence, studies have described this overlap of fear and anxiety, as the types of fear found (fears of dying, having pain, developing surgical complications, anesthesia, developing disabilities, losing independence, changes in self-image and not being successful in surgery) were associated with high levels of anxiety. The chance of patients experiencing preoperative anxiety among those who were afraid of results of surgery was 2.6 times greater than among those who were not afraid.[28,31]

In the preoperative period, anxiety must be well assessed and managed as a strategy for better care of surgical patients and reduction in postoperative pain, complications and hospital costs. Preoperative visits by nurses and anesthetists, prior conversation with the surgical team, provision of appropriate information about anesthesia and surgery and use of measures such as music therapy and other relaxation techniques are among the strategies for managing anxiety. In one study, a group of patients received an information booklet about angioplasty to clarify doubts before the procedure; this group showed a reduction in fear and anxiety before, during and after the procedure when compared to the control group, reinforcing the importance of educational strategies.[9,28,32,33]

The preoperative nursing visit established in the NP is one of the most effective and safe ways to offer education and psychological support to surgical patients, being essential for patients' physical and emotional preparation. This is an opportune and necessary time for perioperative nurses to prepare patients for surgery, assess the intensity of changes in psychological factors (such as fear and anxiety) and provide complete, continuous and cooperative care.[34,35]

The results of this study are important for care practice: (1) the adequate identification of preoperative fear and anxiety; (2) the recognition that they are frequent in surgical patients; and (3) the understanding that both psychological manifestations influence postoperative pain may be useful in directing perioperative care protocols and personalized analgesic regimens.[29]

The limitations of this study are related to the losses that occurred during participant follow-up, and they impacted the mediation analysis of the variables as it was limited to the first 24 hours after surgery. Therefore, we recommend that the analysis of the mediation effects of variables continues in the long term in future studies. The lack of information about the type of anesthetic is another aspect to be highlighted, as this made statistical analysis of such data unfeasible.

Conclusion

Postoperative pain observed in patients undergoing elective surgery is correlated with preoperative fear and anxiety. Preoperative fear influences postoperative pain for a longer time than anxiety. In the short term, the mediating effect of preoperative fear on postoperative pain is direct. The mediation effect of anxiety is indirect, but intensifies the effect of fear.

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Collaborations

Teixeira GL, Marques DG, Santos EA, Hortense P, Napoleão AA, Carvalho EC and Eduardo AHA contributed to study design, data analysis and interpretation, article writing, relevant critical review of intellectual content and approval of the final version to be published.

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